CLAIMS

1. A substrate-based assembly for carrying optical and/or electrical components, the substrate-based assembly comprising a packaging layer, wherein the packaging layer comprises a glass material having both organic and inorganic components.

2. A substrate-based assembly according to Claim 1 wherein the glass material includes an organic component which polymerises by cross-linking.

3. A substrate-based assembly according to either one of the preceding claims wherein the glass material includes an organic component which polymerises under thermal or photo treatment.

4. A substrate-based assembly according to any one of the preceding claims wherein the glass material includes at least one of an epoxy component, aluminium oxide and silicon oxide.

5. A substrate-based assembly according to any one of the preceding claims wherein the glass material comprises an inorganic matrix provided at least in part by a metal alkoxide or salt, the metal alkoxide or salt each being hydrolysed in provision of the inorganic matrix.

6. A substrate-based assembly according to claim 5 wherein the metal alkoxide or salt is based on groups 3A, 3B, 4B and/or 5B of the Periodic Table.

7. A substrate-based assembly according to any one of the preceding claims wherein the glass material includes at least one hydrocarbon compound from the group comprising acrylates, epoxides, alkyls, alkenes, and aromatic groups.

8. A substrate-based assembly according to any one of the preceding claims wherein the coefficient of thermal expansion of the packaging layer approaches that of the substrate material.

9. A substrate-based assembly according to any one of the preceding claims which further comprises electrical interconnect material for providing electrical connection to at least one component packaged by the packaging layer.

10. A substrate-based assembly according to Claim 9 wherein the coefficient of thermal expansion of the packaging layer approaches that of the electrical interconnect material.

11. A substrate-based assembly according to either one of Claims 8 or 10 wherein the coefficient of thermal expansion of the packaging layer differs from the coefficient of thermal expansion of the electrical interconnect material and/or the substrate material by not more than 15 parts per million.

12. A substrate-based assembly according to any one of claims 9, 10 or 11 which further comprises at least one contact pad for a wire bond to the at least one component, the electrical interconnect material being present in said contact pad or wire bond.

13. A substrate-based assembly according to any one of claims 9, 10 or 11 which further comprises at least one mounting pad for mounting the at least one component, the electrical interconnect material being present in said mounting pad.

14. A substrate-based assembly according to any one of the preceding claims, comprising a bump bonded optical component.

15. A substrate-based assembly according to any one of the preceding claims wherein the material of the packaging layer is lithographically patterned.

16. A substrate-based assembly according to Claim 15 wherein the material of the packaging layer comprises at least one organic material which photopolymerizes, the at least one organic material being selected from the group comprising acrylates, epoxides, alkyls, alkenes, and aromatic groups.

17. A substrate-based assembly according to any one of the preceding claims wherein the packaging material has a processing temperature of not more than 450°C.

18. A substrate-based assembly according to any one of the preceding claims wherein the packaging material has a processing temperature of not more than 200°C.

19. A substrate-based assembly according to any one of the preceding claims wherein the packaging material has a processing temperature of not more than 150°C.

20. A substrate-based assembly according to any one of Claims 17, 18 or 19 wherein the packaging material is fabricated from a material comprising a polymerisation initiator.

21. A substrate-based assembly according to any one of the preceding claims which comprises at least one optical component and at least one electronic device.

22. A substrate-based assembly according to Claim 21 wherein the at least one electronic device comprises an integrated circuit.

23. A substrate-based assembly according to any one of the preceding claims which comprises at least one active optical component and at least one passive optical component.

24. A substrate-based assembly according to any one of the preceding claims having a substrate comprising at least one material from the group comprising silicon, glass, composite materials, ceramics and printed circuit board.

25. A substrate-based assembly according to any one of the preceding claims wherein the packaging layer is a passivation layer.

26 A substrate-based assembly according to any one of the preceding claims wherein the packaging layer is a planarisation layer.

27 A substrate-based assembly according to Claim 26 wherein the planarisation layer provides an optical function in use of the assembly.

28 A substrate-based assembly according to Claim 27 wherein the optical function comprises waveguiding.

29 A substrate-based assembly according to any one of Claims 25 to 28 wherein the planarisation layer is provided with at least one aperture to give access to an electrical interconnect structure.

30 A substrate-based assembly according to any one of Claims 25 to 29 wherein one or more components or devices is mounted at least partially on the planarisation layer and the planarisation layer provides support to said one or more components or devices.

31. A substrate-based assembly according to any one of the preceding claims comprising at least two packaging layers, each of said at least two packaging layers comprising a glass material having both organic and inorganic components.

32. A substrate-based assembly according to Claim 31 wherein the refractive index of a first of the at least two packaging layers is different from the refractive index of a second of the at least two packaging layers.

33. A substrate-based assembly according to any one of the preceding claims wherein the packaging layer, or at least one packaging layer, transmits optical radiation in use of the assembly.

34 A substrate-based assembly according to any one of the preceding claims wherein the packaging layer, or at least one packaging layer, provides a waveguiding function in use of the assembly.

35 A substrate-based assembly according to any one of the preceding claims wherein the packaging layer, or at least one packaging layer, provides an alignment feature for use in aligning an optical component in the assembly.

36 A substrate-based assembly according to any one of the preceding claims wherein the packaging layer, or at least one packaging layer, provides refractive index matching in use of the assembly.

37 A substrate-based assembly according to any one of the preceding claims wherein the packaging layer, or at least one packaging layer, provides bonding between optical components in the assembly.

38. A substrate-based assembly according to any one of the preceding claims comprising at least one active optical component.

39. A substrate-based assembly according to Claim 38 wherein the active optical component comprises a laser or a tunable optical source.

40 A substrate-based assembly according to either one of claims 38 or 39 wherein the at least one active optical component is bump-bonded in the assembly.

41 A substrate-based assembly according to any one of claims 38, 39 or 40 wherein the at least one active optical component is flip-chip mounted in the assembly.

AMENDED CLAIMS

[received by the International Bureau on 2 June 2004 (02.06.04);
Original claims 48-50 and 53 amended; remaining claims unchanged (2 pages).]

42. A substrate-based assembly according to Claim 41, further comprising an optical modulator, external to the laser or tunable optical source.

43. A substrate-based assembly according to any one of the preceding claims wherein the substrate-based assembly comprises a thick substrate-based assembly.

44. A substrate-based assembly according to any one of the preceding claims wherein the substrate-based assembly has a thickness in the range from 1 micron to 1 millimetre.

45. Opto-electronic equipment comprising a substrate-based assembly according to any one of the preceding claims.

46. A method of packaging a substrate-based assembly, which method comprises the step of providing a packaging layer comprising a glass material having both organic and inorganic components.

47. A method of packaging a substrate-based assembly according to Claim 46, wherein the method further comprises the step of lithographic processing of the packaging layer.

48. A method of fabricating a substrate-based assembly, the assembly comprising at least one optical component mounted in relation to a substrate, the method comprising lithographic processing of each fabricated layer of the substrate-based assembly, at least one fabricated layer comprising a glass material having both organic and inorganic components.

49. A method of fabricating a substrate-based assembly, the assembly being according to any one of Claims 1 to 44, using bump bonding material to bump bond at least one optical component to a mounting pad, wherein the method comprises the steps of:

a) maintaining the temperature of the bump bonding material above a softening temperature for the material and micro-manipulating the component in relation to the mounting pad; and

b) lowering the temperature of the bump bonding material to below said softening temperature so as to achieve bump bonding.

50. A method of fabricating a substrate-based assembly comprising the step of using gray scale lithography to fabricate a groove of tapered cross section in a packaging layer for mounting a fibre for optical coupling with an optical component, said packaging layer comprising a glass material having both organic and inorganic components.

51. A method of fabricating a substrate-based assembly according to any one of clams 1 to 44 which comprises the step of depth adjustment in a packaging layer.

52. A method of fabricating a substrate-based assembly according to Claim 51 wherein said step of depth adjustment comprises the use of a lithography mask having non-uniform optical density.

53. A method of fabricating a substrate-based assembly comprising the steps of applying an electrical interconnect structure to a surface, applying a planarisation layer over the electrical interconnect structure and creating one or more apertures in the planarisation layer to give access to the electrical interconnect structure, said planarisation layer comprising a glass material having both organic and inorganic components.

42. A substrate-based assembly according to Claim 41, further comprising an optical modulator, external to the laser or tunable optical source.

43. A substrate-based assembly according to any one of the preceding claims wherein the substrate-based assembly comprises a thick substrate-based assembly.

44. A substrate-based assembly according to any one of the preceding claims wherein the substrate-based assembly has a thickness in the range from 1 micron to 1 millimetre.

45. Opto-electronic equipment comprising a substrate-based assembly according to any one of the preceding claims.

46. A method of packaging a substrate-based assembly, which method comprises the step of providing a packaging layer comprising a glass material having both organic and inorganic components.

47. A method of packaging a substrate-based assembly according to Claim 46, wherein the method further comprises the step of lithographic processing of the packaging layer.

48. A method of fabricating a substrate-based assembly, the assembly comprising at least one optical component mounted in relation to a substrate, the method comprising lithographic processing of each fabricated layer of the substrate-based assembly.

49. A method of fabricating a substrate-based assembly using bump bonding material to bump bond at least one optical component to a mounting pad, wherein the method comprises the steps of:

a) maintaining the temperature of the bump bonding material above a softening temperature for the material and micro-manipulating the component in relation to the mounting pad; and

b) lowering the temperature of the bump bonding material to below said softening temperature so as to achieve bump bonding.

50. A method of fabricating a substrate-based assembly comprising the step of using gray scale lithography to fabricate a groove of tapered cross section in a packaging layer for mounting a fibre for optical coupling with an optical component.

51. A method of fabricating a substrate-based assembly according to any one of clams 1 to 44 which comprises the step of depth adjustment in a packaging layer.

52. A method of fabricating a substrate-based assembly according to Claim 51 wherein said step of depth adjustment comprises the use of a lithography mask having non-uniform optical density.

53. A method of fabricating a substrate-based assembly comprising the steps of applying an electrical interconnect structure to a surface, applying a planarisation layer over the electrical interconnect structure and creating one or more apertures in the planarisation layer to give access to the electrical interconnect structure.